

CLAIMS

What is claimed is:

5    1. A process for preparing a modified polyamide, comprising:  
      contacting a reactant polyamide and (i) a chain extender compound selected  
      from the group consisting of bis-N-acyl bislactam compounds and mixtures thereof  
      and a functional diamine or triamine compound or (ii) a functional chain extender  
      selected from the group consisting of functionalized bis-N-acyl bislactam compounds  
10    and optionally a functional diamine or triamine compound, in a liquid phase,  
      the reactant polyamide having a starting RV, a concentration of amine end  
      groups (AEG(R)), and a concentration of carboxyl end groups (CEG(R)), the  
      functional diamine or triamine compound having a concentration of amine end  
      groups of AEG(F), the chain extender compound having a concentration of lactam  
15    end groups (LEG) of at least about 10 equivalents per million grams of the reactant  
      polyamide less than the sum of AEG(R) and AEG(F), for a duration of about 0.5  
      minutes to about 10 minutes, increasing the RV of the reactant polyamide.

20    2. The process of Claim 1, wherein the reactant polyamide is selected from the  
      group consisting of poly(hexamethylene adipamide), poly(e-caproamide),  
      polydodecanolactam, poly(tetramethyleneadipamide), poly(hexamethylene  
      sebacamide), a polyamide formed of n-dodecanedioic acid and  
      hexamethylenediamine, a polyamide of dodecamethylenediamine and n-  
      dodecanedioic acid, copolymers thereof, and mixtures thereof.

25    3. The process of Claim 1, wherein a chain extender compound (i) is used.

30    4. The process of Claim 1, wherein the chain extender compound or functional  
      chain extender is selected from the group consisting of bis-N-acyl bis-caprolactam  
      compounds and mixtures thereof.

35    5. The process of Claim 1, wherein the chain extender compound or functional  
      chain extender is selected from the group consisting of isophthaloyl bis-caprolactam,

adipoyl bis-caprolactam, terphthaloyl bis-caprolactam, (p-phenylene di-terephthalate) N,N' biscaprolactam, and mixtures thereof.

6. The process of Claim 1, wherein the diamine or triamine compounds are  
5 used and are selected from the group consisting of stain resistance agents,  
branching agents, dye site availability modifying agents, and mixtures thereof.

7. The process of Claim 6, wherein:

the stain resistance agent compounds are selected from the group consisting  
10 of o-tolidine disulfonic sodium salts, the branching agent compounds are selected  
from the group consisting of bis (hexamethylene) triamine, and the dye site  
availability modifying agent compounds are selected from the group consisting of  
1,4-Bis (3-aminopropyl) piperazine.

15 8. The process of Claim 1, wherein the modified polyamide is formed into a  
product other than flake.

9. The process of Claim 1, further comprising quenching the modified polyamide  
20 to room temperature such that the product has a concentration of amine end groups  
(AEG(P)) as defined by the formula:

$$AEG(P) = \{AEG(R) + AEG(F) - LEG\} \pm X$$

wherein:

AEG(P) is the concentration of amine end groups in the quenched product in  
25 units of equivalents/1,000,000 gm of the product;

AEG(R) is the concentration of amine end groups in the reactant polyamide in  
units of equivalents/1,000,000 gm of the reactant polyamide;

AEG(F) is the concentration of amine end groups in the functional diamine or  
30 triamine compound in units of equivalents/1,000,000 gm of the  
reactant polyamide;

LEG is the concentration of lactam end groups in the chain extender  
compound or functional chain extender in units of  
equivalents/1,000,000 gm of the reactant polyamide; and

X is any number in a range of about 0 to about 15.

10. The process of Claim 9, wherein X is any number in a range of about 0 to about 5.

5 11. A product made by the process of claim 1.

12. A filament, comprising:

a synthetic melt spun polymer including:

polyamide repeating units or functional diamine or triamine units ( $R_1$ );

10 polyamide chain extender moieties ( $R_2$ ), each independently, selected from the group consisting of optionally functionalized bis-N-acyl bislactam moieties;

wherein at least one of functional diamine, functional triamine, or functional bis-N-acyl bislactam moieties are present, and

terminal groups ( $R_3$ ), each independently, selected from the group consisting

15 of a hydrogen atom and a hydroxyl group;

the polymer including chains, each independently, having a chemical structure:



20 wherein y is an integer of 1-14; and

the filament has a formic acid relative viscosity of at least about 30.

13. The filament of Claim 12, wherein the members of the polyamide repeating

25 units ( $R_1$ ), each independently, are selected from the group consisting of (i) -

{CO(CH<sub>2</sub>)<sub>k</sub>-CONH-(CH<sub>2</sub>)<sub>m</sub>NH}<sub>n</sub>-, where k and m, each independently, is an integer of 1-12, and n is an integer of 10-140, and (ii) -{NH(CH<sub>2</sub>)<sub>x</sub>-CO}<sub>z</sub>- where x is an integer of 1-12 and z is an integer of 20-280.

30 14. The filament of Claim 12, wherein ( $R_1$ ) includes functionalized diamine or functionalized triamine units.

15. The filament of Claim 12, wherein the optionally functionalized chain extender moieties, each independently, are selected from the group consisting of bis-N-acyl bislactam moieties.

5 16. The filament of Claim 12, wherein the chain extender moieties, each independently, are selected from the group consisting of an isophthaloyl bis-caprolactam moiety, an adipoyl bis-caprolactam moiety, (p-phenylene di-terephthalate) N,N' bis-caprolactam, and a terphthaloyl bis-caprolactam moiety.

10 17. The filament of Claim 12, wherein the functional amine compounds are used and are selected from the group consisting of stain resistance agents, branching agents, dye site availability modifying agents, and mixtures thereof.

15 18. The filament of Claim 17, wherein the stain resistance agent compounds are selected from the group consisting of o-tolidine disulfonic sodium salts, the branching agent compounds are selected from the group consisting of bis (hexamethylene) triamine, and the dye site availability modifying agent compounds are selected from the group consisting of 1,4-Bis (3-aminopropyl) piperazine.